



Contracting out public transport services to vertical partnerships

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ABSTRACT

This paper studies the organisational structure of contracting out transportation operations to a vertical partnership between local authorities and a vertically integrated monopoly. Pricing decisions are delegated to the partnership operating in the downstream market as a socially concerned firm that maximises a weighted sum of social welfare and profits. The price for essential input required to produce each unit of the transportation service is determined by the monopoly in the upstream market for rolling stock and crew leasing. A forward ownership interest in the vertical partnership held by the monopoly yields a partial rebate of the downstream margin. In turn, the local authorities can extract the upstream monopoly rent via a franchise fee which can be determined ex post. Our theoretical model predicts that local authorities with a relatively high share in the partnership should decrease the net transfer from the budget by increasing the franchise fees if the upstream profit margins are high. The empirical evidence for the impact of the ownership structure on contractual regime is found in the panel data for 25 suburban passenger companies in Russia in 2011–2015, where partial cost recovery and inappropriate compensation plays the role of pseudo-franchising contracts.

1. Introduction

This paper addresses the issue of three-level structures of local public transport when politicians interact with transportation firms indirectly through an intermediary. We consider the specific organisational realisation of the Strategic/Tactical/Operational (STO) framework, outlined by van de Velde (1999), where certain managerial and regulatory tasks at the tactical level are delegated to a separate entity. The rationale for such an institutional innovation might be to benefit from competences and expertise of the private sector, ensure the long-term sustainability of the demand for public transport and preserve it from the short-sightedness of elected politicians. For instance, in Frankfurt, a city-owned company – *traffiQ* – was established in 2001 as a management organisation which was separated from the transport operator VGF. System planning, customer information, marketing, financing and some other responsibilities were delegated to *traffiQ* that contracted out transportation services to VGF and other transport operators.

In Russia, 25 Suburban Passenger Companies (SPCs) in 73 service areas deliver subsidised services to local commuters, leasing locomotives, passenger coaches, crew, etc. from the rail transport monopoly Russian Railways (RZD). These SPCs were established as joint ventures between local authorities (LAs) and RZD and have relatively diverse corporate structures with the LA's share ranging from 0% to 51%. This diversity provides a factual background for a study of continuum of organisational forms in local public transport.

The conceptual three-level regulatory framework in Russian

suburban railway transportation sector is illustrated in the following scheme (see Fig. 1).

Regional Ministry of Transport designs the Complex Plan for Transportation Services (Transportation Service Contract) and determines the minimum quality requirements. An integral part of this contract is the federal budget commitment to pay 99% of infrastructure charges directly to the RZD. Thus, without loss of generality, we can think of SPCs incurring mostly variable cost, c . Politically motivated and socially concerned Regional Regulator sets the tariff P at the socially desirable level. It also employs a simple cost reimbursement rule to calculate the amount of lump-sum subsidy required in case when the actual tariff P is set below the average cost. Local Ministry of Finance decides on the actual amount of subsidy T that is ultimately paid to SPC. Importantly, the Ministry of Finance and Regional Regulator may have different objectives and resource constraints, so the actual subsidy may turn out to be below the required one. Such anomaly is explained in the paper.

We build a theory that describes the financial mechanism of contracting out public transport services to a partnership between the LA and a transport monopoly. Our theoretical model predicts that the socially desirable financial scheme depends on the organisational form of the partnership. We consider the case of vertically related markets when an upstream monopoly provides essential input (rolling stock and crew leasing) to a downstream joint venture company which is structured as a partnership co-owned by the benevolent local authorities and

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the monopolist. We call such structure a *vertical partnership*, since a forward ownership interest held by an upstream firm may yield a partial rebate of the downstream margin making it optimal to set the non-regulated input price below the monopolistic level. The vertical partnership operates the suburban rail passenger transport (a downstream market) and its costs can be financed through public funds and user charges. Thus, this market is regulated at the local level by means of two independent instruments – tariffs for users and public subsidies. The infrastructure access charges are subsidised by the federal budget and not considered to be within the model.

Our main theoretical results crucially depend on the assumption that local authorities use tariffs and budget transfers independently. In particular, they are able to extract the upstream monopoly's rent via a franchise fee which can be set after the pricing decision of the monopoly takes place and has the form of a negative ex post budget transfer. Intuitively, the franchise fee should increase with an upstream rent until the firm's participation constraint becomes binding. In turn, the downstream loss (if any) incurred by the partnership is related positively to an upstream rent. Thus, if an upstream monopoly cannot be regulated directly, the government can still extract its rent by establishing a so called *pseudo-franchising* contractual framework. Specifically, when the local government faces fiscal constraints and only partially covers the gap between farebox revenues and the operational cost of the partnership, the uncompensated loss can be ultimately passed on to the monopolist through its ownership interest in the partnership. We interpret such an uncompensated loss as a franchise fee paid by the monopoly for the right to deliver intermediate services at a non-regulated price.

Our model provides a conceptual framework for the discussion of a continuum of alternative contracting scenarios in vertically related markets for public transport ranging from standard regulation to complete privatisation. The analysis is articulated as follows. The next section discusses the related literature on outsourcing and vertical integration. The factual background of the regulatory framework in suburban rail services in Russia is laid out in Section 3. Section 4 presents a formal model of public contracting as a regulatory game with a delegation of price setting decisions to a vertical partnership with predetermined share structure. Section 5 empirically tests our main theoretical findings using panel data regressions for 25 SPCs in Russia. Section 6 discusses the practical relevance and limitations of our results and concludes the paper.

2. Related literature

2.1. Outsourcing vs vertical integration

The question of optimal contractual design in vertically related markets has been studied at the theoretical level by two related but still largely disconnected streams of literature, namely outsourcing in the public service provision and vertical integration in infrastructure industries. To our best knowledge one of the first attempts to address these issues in a unified theoretical approach was Hart (2003). He develops the incomplete contract framework by generalising the contractual principles that grounded both the privatisation and the vertical integration traditions in the literature. In the former case the ownership choice is shaped by the form of a regulatory contract in the context of a natural monopoly. As in the latter case, the main concern is how to shape the relationships between the parties through an arms-length contract or through a transfer of ownership.

Our paper considers an environment where regulatory and ownership issues are channelled through a share structure of the partnership between the government and monopolist. Thus, instead of analysing polar and discrete forms of vertical integration separately we introduce a framework where lower share of the government in the partnership implies both greater degree of privatisation and greater scope of vertical integration between the downstream public service provision and the upstream monopolist.

2.2. Outsourcing vs regulation

The question whether the privatised monopoly should be regulated is addressed by Kidokoro (2003) who adds a quality dimension in a transport demand function. He claims that it is more desirable for local authorities to regulate the final price even after contracting out service provision to a private transport company, i.e. after privatisation. The author suggests that contracting out local transport services may be useful in areas with low possibilities of new entries and small potential for a decrease in operating costs. These conclusions are largely driven by the assumption of a zero cost of public funds and zero weight on the private transport firm's profit in the regulator's objective function.

The rationale for outsourcing lies not only in the political domain as outlined by Hart (2003), but also reflects certain fiscal constraints represented by a local cost of public funds at the local government level as

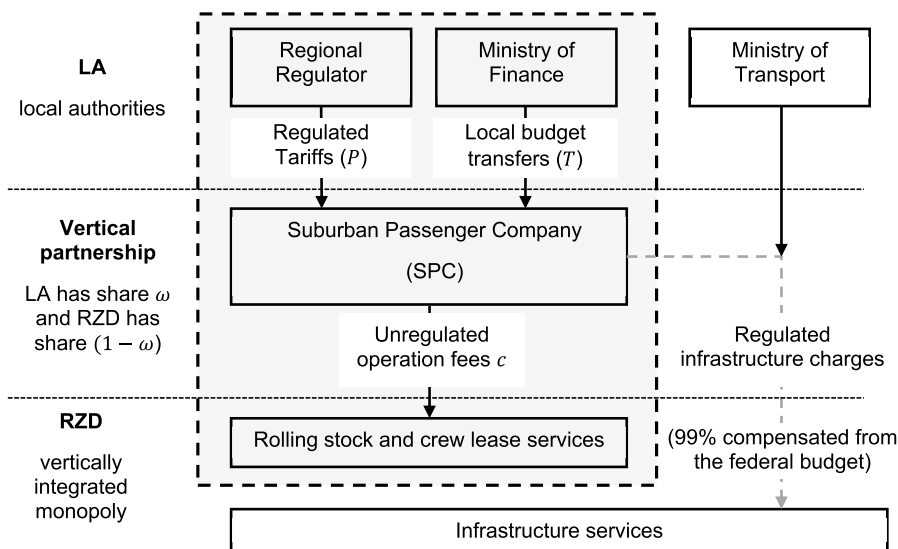


Fig. 1. The regulatory framework in suburban rail transport in Russia (2010–2018).

argued by [Auriol and Picard \(2009\)](#). An optimal public-private agreement with a regulated private monopoly may be a form of an outsourcing decision that thus depends on the shadow cost of public funds. In a setup, based on [Baron and Myerson \(1982\)](#) framework, [Auriol and Picard \(2009\)](#) have come to very different results as compared to [Kidokoro \(2003\)](#). They abstracted from any quality issues making the two regulatory instruments, price and output, linked by the demand constraint, and explicitly accounted for the shadow cost of public funds. The benevolent utilitarian government maximises the unweighted sum of consumer's and producer's surpluses minus the social cost of transferring public funds to the firm. The government chooses between regulation (which is interpreted as an in-house provision of public services without ex ante transfer of ownership rights to the private sector) and outsourcing (which implies delegation of price setting decisions to a private unregulated firm in exchange for a franchise fee). Naturally, since the firm chooses the monopoly output which proves to be socially suboptimal, the government opts for a welfare improvement by offering an ex post contract: higher output plus compensatory transfer. The incentive compatibility constraint here implies that the private firm accepts the ex post contract only if it allows to secure at least monopoly profit. The authors show that outsourcing is optimal for any cost of public funds if the government is able to extract the firm's information rent through ex ante franchise fees.

Indeed, in very poor areas where the main focus of local governments is on tax collection, outsourcing may take the extreme form of unregulated yet unsubsidized and, very likely, informal private sector monopoly, like minibus taxi cartels in South Africa (see [Kerr, 2018](#)). Admittedly, price regulation per se is often associated with deterioration of quality which can hardly be mitigated by a competitive tendering mechanism in these areas due to low contestability of such markets. Moreover, as pointed out in [Balduzzi \(2011\)](#), in developing countries with a relatively higher degree of corruption within the government, a regulator's objective function de facto accounts for a private benefit for the public provider. Given such self-interest of the government, the social welfare function is viewed as an unweighted algebraic sum of objective functions of the parties' net of the social cost of the project.

2.3. Hybrid arrangements

The distinction between the welfare-maximising government and private firms may be less sharp when we deal with public-private partnerships, non-profit or socially concerned firms (see [Bennett and Iossa \(2010\)](#), as well as [Iossa and Martimort \(2012\)](#)). [Makovšek and Moszoro \(2017\)](#) compare the public cost of borrowing with the private cost of finance and conclude that the argument of cheaper financial source is inadequate to rationalise the outsourcing scheme. Instead, they argue that public-private partnerships commit to the public sector by paying an agreed income (a sort of franchise fees) to the special purpose vehicle (SPV), as long as the required service delivery and quality criteria are met. Alternatively, the public sector can grant the SPV the monopoly right to collect revenues from the users.

Our modelling framework also implies a certain adjustment of the relative weights in the social welfare function once the parties are engaged in the partnership. Yet, we interpret greater commercial consideration of the local governments participating in the partnership as a natural protection from excessive political pressure and a second-best response to the lack of sufficient funds to fully compensate operating losses of the transport firm. In turn, we employ the same logic as in [Auriol and Picard \(2009\)](#) when considering the incentive compatibility constraint of the vertical partnership between the government and the private vertically integrated firm. We depart from their analysis by considering hybrid organisational arrangements (vertical partnerships) that range from standard regulatory contracts to unregulated private monopoly. Our model focuses on government's incentives to use various forms of contracting out in the presence of fiscal constraints and high shadow cost of public funds.

3. Contracting out suburban rail services in Russia

The last 15 years of railway reform in Russia have witnessed a transition from weakly enforced public service obligation (PSO) agreements in local transport sector to delegation of contracting of suburban rail services to operating companies with mixed corporate structures. Jointly owned by local authorities and regional divisions of the vertically integrated Russian Railways (RZD) monopoly, these suburban passenger companies (SPCs) were designed as asset-less partnerships to ensure greater cooperation between the parties. In particular, the idea to establish sort of trusting partnerships, explored in [Dementiev and Loboiko \(2014\)](#), has been to mutually benefit from the revelation of private information and create room for social welfare improvement via the elimination of information rent which is pertinent to a standard regulatory framework.

In practice, however, most of the established partnerships found themselves caught between the devil and the deep blue sea in the absence of adequate budget financing and demonstrated lack of trust between the partners. According to standard corporate procedures they started suing the local authorities (ironically, one of their shareholders and tariff setter) seeking recovery of costs. Intriguingly, about 70–80% of SPCs' costs were attributed to services provided by the railway monopolist RZD (the other shareholder). Several cashless regional governments have opted for relatively cheaper alternatives and switched to bus services. That has undermined the very idea of the partnership deemed to operate in the suburban rail transportation market.

Evidently, the problem was largely caused by a weak institutional framework with a lack of commitment to compensate operational losses ex post. The recent government's initiative to tender an ex-ante specified regulatory contract, which would guarantee so called participation condition by any potential operator, is a step in the right direction. Besides, due to the incumbency of 25 established SPCs and their experience, it seems likely that these contracts will be either directly awarded to or won in tender by the existing region-based local SPCs with inherited corporate structure.

Apparently, very few regions in Russia fully compensate operation losses through their budget (see [Table 1](#)). Some regions (the line 'Not provided') have never planned to transfer any funds to the transportation sector. In 2011–2014 the majority of local authorities consistently compensated only partially for the operating losses of SPCs. In the standard ex ante contracting out scheme such a violation of the firm's participation constraint would cause a market foreclosure. This is what we observe in one Russian region in 2015–2017 when suburban transportation by rail was simply stopped. However, in most cases operations continued despite the subsidisation ratio (the share of SPC's operating losses compensated from the budget) being less than 100%.

Obviously, a potential theoretical explanation of such a weak institutional framework with uncertain public finances would require a conceptually different approach to the monopolist's participation constraint. In the following section we propose a model of 'pseudo-franchising' scheme that captures the basic stylized facts described above.

Table 1
The scope of compensation of operating losses in 73 Russian regions.
Source: RZD Annual Reports (2016, 2017)

Subsidisation ratio	2011	2012	2013	2014	2015	2016	2017
Payment is not required	6	5	4	4	5	5	5
100% compensation	11	18	11	15	41	36	32
> 80% compensation	9	6	10	8	12	15	12
50–80% compensation	13	8	13	21	4	6	7
< 50% compensation	30	32	32	21	9	8	15
Not provided	4	4	3	4	1	2	1
Transportation stopped	–	–	–	–	1	1	1

4. Theoretical analysis

4.1. A model setup

Consider a regulatory game between the local authorities (LA), a vertically integrated transport monopoly and the partnership between the two. The monopoly provides essential input produced in the unregulated upstream market and sells it to the partnership which then delivers final services in the regulated downstream market. The role of the partnership is threefold. Firstly, being obliged to disclose its financial statements it eliminates the cost asymmetry between the LA and the firm that allows us to consider a regulatory framework with complete information developed in [Dementiev and Loboyko \(2014\)](#). Secondly, being a joint venture between the government and the firm, it mediates public-private relations and, by design, performs as a socially concerned price-setter. Alternatively, one could interpret the mixed objectives of such a partnership as a regulatory regime with delegation of pricing decisions to a more commercially oriented entity as in [Dementiev \(2016\)](#). Thirdly, the control rights in the partnership reflect the abilities of the parties to affect the distribution of the total surplus by means of lump-sum transfers from the budget to the partnership and from the partnership to the firm. The latter consideration will be crucial for our results.

The monopoly firm incurs constant unit cost $v \geq 0$ as well as non-negative fixed cost $K \geq 0$ in the upstream market for essential input (rolling stock and crew lease) which is sold at a unit price $c \geq 0$ to a partnership. In turn, the partnership produces at no additional cost a homogenous service (transportation) in the downstream market and sells it at a regulated unit price $P \geq 0$. To obtain, where possible, closed form solutions, we consider a linear demand function $Q = 1 - P$ with the maximum willingness to pay normalised to 1. Due to our assumption of linear technology the demand in both markets is shaped by the same function, implying that every unit of transportation service in the downstream market requires exactly one unit of essential input in the upstream market.¹

Naturally, such a distinction between the stages of production in vertically related markets is irrelevant if an upstream monopoly is fully vertically integrated with the downstream firm and the final price P is regulated. However, it appears to be crucial for the case of *vertical partnership* when the share $\omega \in [0,1]$ of the downstream division of the vertically integrated firm is owned by the LA while $(1 - \omega)$ belongs to the upstream monopolist. The price setting rule as well as profit sharing principles will then result from the organisational design of such a public-private agreement. The partnership has no strategic role by itself and simply mediates the relationships between the LA and the monopolist. When the LA's share is less than one, $\omega < 1$, price regulation in the downstream market is in fact delegated to a more commercially oriented entity with predetermined balance of interests.

4.2. The players' objectives

4.2.1. Social planner

The social welfare function comprises a weighted sum of the net consumer surplus, CS and the industry's profit, $\pi = \pi_F + \pi_P$, which sums up a profit of the vertically integrated firm, π_F , and a partnership's profit, π_P . The joint weighted surplus $CS + \alpha\pi$ is reduced by a lump-sum net transfer $(1 + \lambda)T$ to account for an additional loss of social

¹ In fact, there are two essential inputs in the rail transportation market: rolling stock and crew lease. In practice, the costs and prices of these inputs may not vary in a synchronized way. However, without loss of generality we can abstract from this difference if both inputs are delivered by a single firm. A natural interpretation of one additional unit of essential input (supplied at cost v) would be one more train km operated by the current fleet of vehicles and staff (which incurs a fixed cost K).

welfare λT due to distortionary taxes levied on consumers, where $\lambda \geq 0$ is the local cost of public funds. A redistributive parameter $\alpha \in [0,1]$ reflects the societal concerns for the producers' surplus which implies lower relative weight associated with the industry's profit in the extended social welfare objective function of a politically motivated regulator (see [Gagnepain and Ivaldi \(2017\)](#) for a model of political regulation and estimation of α and λ for the French urban transport industry). Using expression for the gross consumer surplus $CS(P) = (1 - P)^2/2$ we may formulate the following social welfare maximisation problem:

$$\max_{P,T} W = \max_{P,T} \frac{(1 - P)^2}{2} - (1 + \lambda)T + \alpha\pi \text{ subject to } \pi, P \geq 0 \tag{1}$$

The benevolent regulator chooses a price-transfer combination (P, T) . Notably, the redistributive parameter α is irrelevant for the optimal solution when the social planner is able to extract all industry's profits by setting $\pi = 0$. When regulatory capacity is limited and $\pi \neq 0$, the societal redistributive concerns affect the pricing decision of a politically motivated regulator, such that $\partial P/\partial \alpha > 0$ (see Lemma 1 in [Dementiev and Loboyko \(2014\)](#) for the proof). That is, given the unit cost of production a more socially concerned regulator (with lower α) would set lower tariff. Hereinafter, we impose a reasonable parameter restriction on α , namely $\alpha > 0.5$. This is an empirically valid assumption and allows us to obtain meaningful and interpretable results.

However, in case of vertical partnership the downstream unit price is not given, rather it is set by the unregulated monopolist. Consequently, the regulator may wish to adhere to transfer as an additional regulatory instrument which can be used independently of prices as in [Armstrong and Sappington \(2006\)](#). Following the idea of ex post contracting developed in [Auriol and Picard \(2009\)](#) we make a clear distinction between the ex ante and ex post transfers. This difference in timing of subsidies is essential for our explanation of different contracting regimes. Since the level of net transfer affects the firm's participation constraint we will return to this issue later after having obtained the closed form solutions for the optimal price levels and associated net transfers.

4.2.2. The vertical partnership and delegation of price regulation

It is not uncommon when politically motivated regulators tend to set prices below average (and in our case marginal) cost redistributing social wealth from the taxpayers to transport service users. If local budgets are much of a concern, a subsidy to a firm becomes too costly for the society, since it values the firm's surplus less than the taxpayers' loss, because $1 + \lambda > \alpha$. As [Dementiev \(2016\)](#) shows, to mitigate possible political bias in decision making the price setting can be delegated to a partnership (between the LA and the monopolist) with the following objective function:

$$\max_P U_P = \max_P \{\omega W + (1 - \omega)\pi\} \text{ subject to } \pi \geq 0 \tag{2}$$

In the case of full public ownership of the partnership, when $\omega = 1$, the maximand coincides with the social welfare function (1) and we have a standard regulatory problem. At the other extreme, when $\omega = 0$, the regulator effectively maximises the profit of the partnership which is solely owned by the upstream firm. The latter case of a full vertical integration may also be interpreted as a regulatory capture since private profits become the only concern of the regulator. We will consider further a hybrid organisational structure of the partnership with $0 < \omega < 1$ which reflects not only greater commercial concerns in pricing decision but also the scope of vertical integration in the industry.

Since pricing decisions in the downstream market are delegated to the partnership, the regulated price P depends on its share structure. Intuitively, when the LA's share in the partnership decreases, it becomes more commercially oriented and tends to set higher P for any price level below the monopoly one. Formally, having delegated the price-setting decision to the partnership the new regulatory objective function transforms (2) into

$\max_P \{\omega(CS - (1 + \lambda)T + \alpha\pi) + (1 - \omega)\pi\} = \max_P \omega(CS - (1 + \lambda)T + \psi\pi)$, where the effective weight ψ placed on the industry's profit by the partnership is higher than that of a politically biased regulator. Indeed, $\psi = \alpha + 1/\omega - 1 > \alpha$ for any $\omega < 1$, moreover ψ decreases in ω .

For a given level of lump-sum transfers T the optimal regulated price P_ψ set by the partnership with the LA's share ω in the downstream market is equal to $P_\psi(c) = (1 - \psi(1 + c))/(1 - 2\psi)$ which increases in ψ (see Dementiev (2016) for the formal proof of these formulae). As was mentioned, the demand for essential input in the upstream market is also determined by this price and is equal to $(1 - P_\psi)$. Naturally, it is related to an upstream unit cost c which can now be optimally chosen by the (partially) vertically integrated monopolist.

4.2.3. The vertical integration and consolidation of profits

The vertically integrated monopolist chooses c to maximise the sum of its upstream profit and its downstream affiliate's net financial result which is added with the weight $(1 - \omega)$ reflecting the scope of the monopolist's participation in the vertical partnership. The consolidated profit then takes the form:

$$\max_c \pi_F = \max_c \{(c - v)(1 - P(c)) - K + (1 - \omega)\pi_P(c)\} \tag{3}$$

Importantly, the firm is not regulated in the upstream market while the demand for essential input is determined by the regulated price $P(c)$ in the downstream market which in turn is a function of c . Thus the monopolist, being unregulated, is assumed to receive no funds from the budget directly. Yet, it may receive subsidies indirectly through its ownership interest in the regulated partnership. In fact, the monopolist faces a trade-off between the two financial sources to cover its fixed cost K : direct profit or loss in the upstream market and consolidated financial result of the partnership. If an increase in the monopoly markup $(c - v)$ increases revenues in the upstream market it in turn squeezes the profit margin in the downstream market. Reduced downstream profitability π_P may outweigh the first effect if the firm's interest in the partnership $(1 - \omega)$ is sizable (the LA's share ω is relatively low).

4.2.4. The vertical partnership and contracting out downstream services

As we pointed out earlier, the partnership operates the regulated downstream market for transportation services as a socially concerned contractor. The scope of contracting out depends on ω , that allows us to consider a continuum of alternative organisational structures in the sector. It's important to remind here that the partnership structure $(\omega, 1 - \omega)$ affects both the downstream market price determined by (2) through the mechanism of delegated regulation and the scope of vertical integration determined by (3) through the channel of profit consolidation. For any $\omega < 1$, i.e. when transportations services are contracted out to the partnership, the regulator solves (2) and sets higher downstream price P_ψ compared to the case (1) with no delegation, because P_ψ decreases with ω .

Indeed, politicians may opt for setting relatively low fares for electoral purposes. Such a political influence, captured by low α in our model, may be at least partially mitigated when regulation is delegated to a more commercially oriented partnership. Still, the price P_ψ may be below the unit cost c causing operational losses of the partnership and requiring subsidies from the budget. Thus, by decreasing its interest in the partnership (thus increasing the scope of contracting out), the government may attempt to lessen its financial burden and reduce the subsidy that covers operational losses.

In this setup the vertical partnership behaves as a price-taker because neither price P_ψ no cost c can be controlled. Its financial result $\pi_P = (P_\psi(c) - c)(1 - P_\psi(c)) + T$ depends on the net subsidy T which takes the form of ex-post lump-sum transfer payment from the budget.

4.3. The timeline of the regulatory game

Two regulatory instruments, the price P_ψ and the lump-sum subsidy

T , are used independently. Here we make the crucial assumption, that the net subsidy from the budget T comprises of the operational subsidy t which is determined ex ante and a (potentially negative) transfer F which is determined ex post, so $T = t - F$. Operational subsidy follows a simple (variable) cost reimbursement rule: $t = -(P - c)(1 - P)$ and can be internalised in the pricing decisions of the partnership and the firm.

Thus, the timeline of the regulatory game is as follows. Firstly, the government chooses the LA's share ω in the partnership. Secondly, the monopolist unconditionally accepts the share $(1 - \omega)$ and chooses the price c for the essential input. Thirdly, the pricing decision is delegated to the partnership and it chooses P_ψ given the cost reimbursement rule for t . Finally, the government chooses F to extract the monopolist's rents, yet ensuring its participation constraint.

This is a two-stage optimisation problem. Having plugged the cost reimbursement rule into the expression for consolidated profit π_F and taking into account that the quantity of the essential input demanded in the upstream market is equal to the quantity of services demanded in the downstream market, we obtain: $\pi_F = (c - v)(1 - P_\psi(c)) - K + (1 - \omega)\pi_P$

$$= (c - v)(1 - (1 - \psi(1 + c))/(1 - 2\psi)) - K - (1 - \omega)F$$

For a given demand $(1 - P_\psi)$ in both vertically related markets the unregulated upstream firm would wish to increase the essential input price c up to the monopolistic level for any $0 < \omega < 1$. However, the regulated price $P_\psi(c)$ is also based on the input price c implying that the monopoly experiences an indirect regulatory pressure through the demand channel. Moreover, the monopoly's profit crucially depends on the ability of the regulator to extract its upstream rent via the ex post transfer F . Importantly, the input price c that maximises the upstream variable profit $V = (c - v)(1 - P_\psi(c))$ is set prior to the government's decision on F . It can be shown that $c_\psi = (v + \psi)/2$ solves (3), where $\psi = \alpha + 1/\omega - 1$.

In the optimum, the firm's profit appears to be dependent on the effective weight ψ of the industry's profit in the regulator's objective function. In particular, $\pi_F^* = \psi(\psi - v)(\psi + v - 2)/4(1 - 2\psi) - K - (1 - \omega)F = V(\omega) - K - F + \omega F$. This result implies that the monopolist's profit crucially depends on the corporate structure of the partnership ω . However, the sign of this relation is ambiguous since $\frac{\partial V}{\partial \omega} < 0$ and F can be positive.

4.4. The ex post franchise fee

Now we can discuss the regulatory regime where the parameter F represents the difference between the 'required' subsidy t and the actual subsidy T , namely: $F = t - T$. When $t > T$ the variable F accounts for the uncovered operational losses of the partnership making its 'net financial result' negative. These losses are divided between the shareholders in proportion to their interests in the partnership. The LA's share ωF is simply a financial flow within the public sector and can be accounted for in the sum of net budget transfer to the partnership.

The share of the partnership's losses $(1 - \omega)F$ is in fact a residual financial burden which is ultimately levied on the monopolist. This net financial result of the partnership can be interpreted as an ex post franchise fee paid by the industry to the government for the monopoly right to operate the non-regulated upstream market. We call it a *pseudo-franchise fee* since it is determined ex post in a specific way. In fact, a subsidy t can be internalised by the firm while the franchise fee F is unknown ex ante and is deemed to be an independent regulatory instrument to extract the monopolist's rent, if necessary.

How can the franchise fee be determined in the absence of any tendering procedures and other forms of competition for the market? The described regulatory environment closely resembles a direct award mechanism with ex post renegotiation of a budget transfer. It is optimal for the society to increase F if the marginal effect of F on the regulator's objective function $\frac{\partial \pi_F}{\partial F} = (1 + \lambda)dF - \psi dF$ is positive. In particular, if $1 + \lambda > \psi = \alpha + 1/\omega - 1$ the marginal social gain from the higher

franchise fee $(1 + \lambda)dF$ exceeds the weighted loss in the industry's surplus $-\psi dF$. This is the case when the local cost of public funds λ or the LA's share in the partnership ω is relatively high.

In practice, it means that the government has incentives to cover the operational losses of the partnership only partially and share the financial burden of public transport subsidisation with the monopolist, provided that its participation constraint is satisfied: $V - K \geq (1 - \omega)F$. If it becomes binding, the variable profit of the monopolist is used to cover the fixed cost K and a franchise fee F . These findings are summarised in the following section.

4.5. Theoretical results

Proposition 1. The regulator will increase the pseudo-franchise fees F , if the actual LA's share in the vertical partnership exceeds a certain threshold: $\omega > \omega_\psi = 1/(2 + \lambda - \alpha)$.

Proof. This result follows directly from the condition $1 + \lambda > \psi = \alpha + 1/\omega - 1$ described above.

When the LA's share in the partnership ω is relatively high for a given value of the local cost of public funds, it effectively puts higher weights to consumer surplus and performs more like a socially oriented firm. In this case, minimisation of budget transfers becomes a socially desirable policy. If and when the government has insufficient institutional capacity to extract the monopolist's rent via ex ante franchise fees, these incentives result in an increase in uncovered losses of the partnership, which can be interpreted as an ex post franchise fees.

Fiscally constrained governments have relatively high local cost of public funds, λ . Since budget subsidies become socially costly, they seek alternative organisational solutions and tend to contract out more services that, in turn, requires lower LA's share in the partnership. In practice, however, changes in corporate structures are rare and governments adjust their budgets via the ex post franchising scheme described above.

Proposition 2. For a given ω the monopolist maximises its variable profit by setting the price for the essential input at $c_\psi = (v + \alpha + 1/\omega - 1)/2$ which decreases in ω .

Proof. This formula combines the expression for the optimal price for essential input $c_\psi = (v + \psi)/2$ obtained above and the formula for $\psi = \alpha + 1/\omega - 1$.

Given the model parameters' restrictions, the variable profit V of the monopolist increases if its share in the partnership $(1 - \omega)$ rises. Indeed, when the scope of contracting out increases (ω falls) the partnership becomes more commercially oriented and tends to set higher input price c_ψ until it reaches the monopolistic level. Naturally, this implies lower profit margins downstream. However, lower ω also implies higher interest of the monopolist in the financial result of the partnership. It means that the loss-making downstream partnership undermines the monopolist's consolidated financial position.

Corollary. There exists a continuum of corporate share structures of the vertical partnership, such that $\omega_F < \omega < \omega_V$, and $\omega > \omega_\psi$, when the regulator is able to extract the upstream profits of the firm via the ex post franchise fee given the firm's participation constraint $(1 - \omega_F)F \leq V - K$.

These theoretical findings are illustrated in Fig. 2. The scope of contracting out increases as LA's share ω in the partnership falls for each level of the local cost of public funds λ . When $\lambda = 0$ and regulators have no political bias towards consumers ($\alpha = 1$) there is no room for contracting out and optimal $\omega_\psi = 1$. The problem of costly public funds ($\lambda > 0$) and politically concerned regulators ($\alpha < 1$) at the local level can be addressed by the social planner if public transport services are contracted out to a properly structured vertical partnership.

For a given α it is optimal to increase the scope of contracting out when the local cost of public funds increases moving along the downward sloping curve in Fig. 2. The government has incentives to

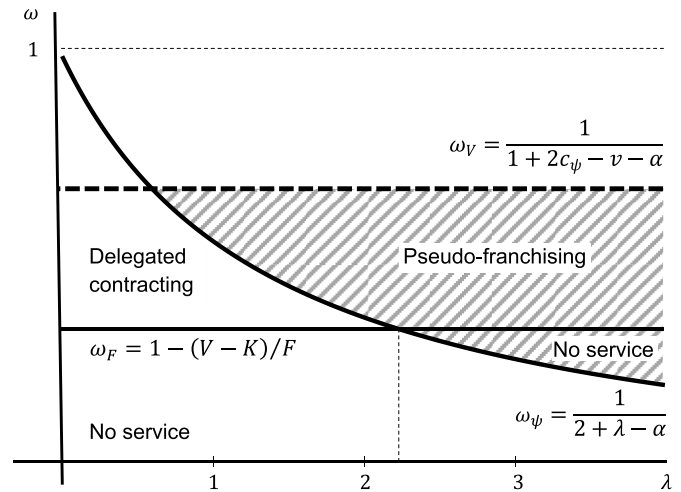


Fig. 2. Contractual regimes for different LA's share in the partnership (ω) and local cost of public funds (λ).

redistribute the wealth from producers to consumers for any combination (λ, ω) above this line. It implies that if the LA's share in the vertical partnership is relatively high it is optimal to extract producer's rents through the ex post franchise fees. On the contrary, for the relatively small LA's share in the partnership commercial interests become more pronounced making ex post redistribution of wealth socially undesirable. Such institutional arrangements resemble much of properties described by Bennett and Iossa (2006) as delegated contracting.

Once the share ω is chosen by the social planner the monopolist sets the essential input price c_ψ and the regulator makes the decision on P_ψ which determines the monopolist's variable profit V . If it is sufficient to cover the fixed cost, i.e. $V > K$, the government may use the organisational capacity of the partnership to extract the amount $(1 - \omega)F$ of the surplus $V - K$ as an ex post franchise fee. The minimum share $\omega_F = 1 - (V - K)/F$ defined in the Corollary and depicted as a solid horizontal line in Fig. 2 reflects the monopolist's participation constraint which is independent of λ . An increase in the fixed cost K (exogenous in our model) shifts this line upwards and enlarges the 'No service' area when the monopolist is unwilling to supply the services.

When the fixed cost is relatively small the monopolist can 'survive' a higher degree of contracting out (a lower ω), which is quite intuitive. If, for instance, the social planner chooses ω_V at the initial stage, such that $\omega_V > \omega_F$, but local fiscal constraints change and become tougher (higher λ), the government may adjust its financial stance by manipulating the ex post budget transfer to the transportation sector. The particular form of such fiscal accommodation could be a franchise fee $(1 - \omega_V)F$ which is a socially optimal policy for any (λ, ω) in the 'Pseudo-franchising' shaded area in Fig. 2.

5. Empirical analysis

Our theoretical model predicts, that if the monopolist increases the nonregulated price of rolling stock and crew leasing the profit margin of the downstream partnership squeezes, implying, other things being equal, a lower farebox ratio (or lower variable cost-recovery rate) of the operating company. In a standard regulatory framework a cost-reimbursement rule would imply full and unconditional compensation of all operational losses with the compensation ratio being equal to unity. Otherwise the operator's participation constraint would be violated.

In case of vertical partnership being an operator in the downstream market, its losses take the form of receivables owed by the partnership to the monopolist for the provision of rolling stock and crew leasing services. A consolidated profit of the monopolist may still remain positive even after taking these losses into account with the weight being equal to its share in the partnership. This implies that in such an

institutional environment a loss-making vertical partnership without adequate budget subsidies may still wish to deliver transportation services.

We turn now to empirical tests for the basic predictions of our theoretical model and focus on the role of the partnership's share structure. We aim to show the non-randomness of the joint realisation of high monopoly mark-ups in the upstream market and high franchise fees extracted by the LAs ex post in the form of insufficient compensation of operational losses of the partnerships from the local budget.

5.1. Data and variables

In order to illustrate the lack of unconditional approach to subsidisation of the local public transport in Russian regions we look at cost-recovery rates and construct a variable *FAREBOX* as ratio of a farebox revenue (ticket sales) to train operating cost for the 25 SPCs in Russia for five consecutive years from 2011 to 2015 inclusive. Using official financial statements and annual reports disclosed pursuant to the Federal Law on Natural Monopolies No. 147 from 17.08.1995 and the Decree No. 158-T of the Federal Service for Tariffs from 19.04.2011 and having dropped one missing data point of Zabaikalsk SPC for 2011 we have been able to collect 124 observations with an unbalanced panel structure (see Table 2).

The variable *LOSS* – operational loss – represents the difference between total cost and total operational revenues. It is negative for profitable companies. The variable *SUB* is the gross lump-sum subsidy paid from the budget to SPC. The variable $SUBRATIO = SUB/LOSS$ is the share of SPCs' losses compensated from the regional budget.

Fig. 3 shows no evidence of any robust relation between the five-year averages for the two constructed ratios unless we take into account the difference in corporate structures of the SPCs. In particular, we observe a positive relation between the five-year average *SUBRATIO* and five-year average *FAREBOX* variables for SPCs with relatively high share in the partnership (marked as grey triangles for $0.26 < \omega < 0.5$ and black squares for $\omega > 0.5$). On the contrary, when the LA's share in the SPC is around 25% or lower (marked as open circles) any correspondence between the cost-recovery rates and the share of compensated losses seems to disappear.

A standard regulatory framework would imply that all operational losses are compensated from the budget irrespective of the cost-recovery rate. This is not the case for our sample since virtually no point lies on the solid horizontal line at the level where $SUBRATIO = 100\%$. Empirically it can be tested as a single linear coefficient restriction in a simple regression of *SUB* on *LOSS*.

Estimation results for this preliminary (and largely naïve) econometric specification at the full sample shows rather weak explanatory power of the pooled OLS regression (see the 'OLS full' column in Table 3). We then apply Chow test and split our data into two subsamples using dummy variable *BLOCK* which is equal to 1 for $\omega > 0.26$ and 0 otherwise. The estimation results for three alternative specifications (pooled OLS, fixed effect and random effect) are presented in the last three columns of Table 3. A pairwise comparison for the preferable

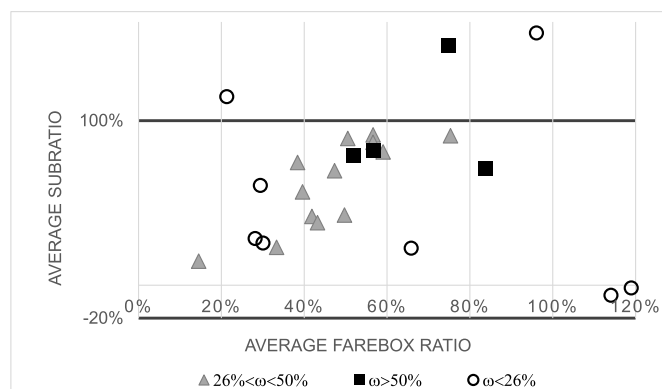


Fig. 3. Compensation ratio vs. farebox ratio for different LAs' shares in SPCs (2011–2014 average).

Table 3

Estimation results for preliminary specifications.

Dependent variable - SUB	OLS full	OLS	FE	RE
<i>LOSS</i>	0.893 (4.20)***	0.554 (15.02)***	0.212 (3.07)***	0.371 (6.72)***
<i>const</i>	255.85 (9.75)***	17.510 (0.63)	205.859 (5.26)***	115.350 (2.25)**
R ²	0.12	0.73	0.12	0.12
N	124	84	84	84

*p < 0.1; **p < 0.05; ***p < 0.01.

specification using Breusch-Pagan LM test, Hausman test and Wald test demonstrate that the FE model is superior to others.

The deviation from unity of the estimated coefficient at *LOSS* variable is statistically significant. It means that operational losses are not fully compensated from the budget and the actual regulatory regime is non-standard. In order to provide empirical evidence for the 'pseudo-franchising' regulatory regime we employ alternative econometric specifications that are based on the theoretical predictions of our model. In particular, taking into account relatively diverse shareholding structure of SPCs' across Russian regions we are going to provide an inference of the role of organisational capacity in subsidisation policy.

5.2. Econometric specification

In order to demonstrate qualitatively different regulatory regimes for different corporate structures of the partnerships we suggest two different specifications. Firstly, we aim to show that the 'pseudo-franchising' regime works for SPCs with relatively large LAs' share. Our model predicts that it should occur for $\omega > \omega_F$ and $\omega > \omega_\psi$. Thus we exclude from our sample 8 SPCs with $\omega < 26\%$ and run the following regression:

$$FRA_{it} = \beta_0 + \beta_1 LOSS_{it} + u_i + \varepsilon_{it}$$

Table 2

Descriptive statistics.

Variable	Comment	Obs	Mean	Std. Dev.	Min	Max
<i>LOSS</i>	Operational Losses	124	351.21	1187.45	-5710.1	2550.8
<i>SUB</i>	Gross Subsidy <i>t</i>	124	287.21	298.50	0	1720.2
<i>SUBRATIO</i>	SUB/LOSS	124	0.635	0.518	-0.221	3.325
<i>FAREBOX</i>	Farebox ratio	124	0.555	0.269	0.078	1.324
ω	LA's share ω	124	0.378	0.1849	0	0.51
<i>BLOCK</i>	Dummy = 1 for $\omega > 0.26$	124	0.323	0.4699	0	1
<i>FRA</i>	(-) Financial Result After	124	63.731	1116.84	-6006.8	1732

where $FRA = LOSS - SUB$ states for the uncovered losses or net Financial Result After subsidies being paid (which we call pseudo-franchise fee), u_i is unobserved time-invariant individual effect and ε_{it} is the error term. The threshold level of 26% is chosen rather arbitrary. Hence, in our second specification we use the full sample of SPCs and account for the diversity in share structures by regressing a weighted franchise fee on losses:

$$(1 - \omega_{it}) \cdot FRA_{it} = \beta_0 + \beta_1 LOSS_{it} + u_i + \varepsilon_{it}$$

Both specifications test the hypothesis that higher loss in the downstream market (*LOSS*) results from higher upstream profits (not observed in our data) and requires a higher franchise fee which the government is able to extract. The causal direction of the relation between *FRA* and *LOSS* can be inferred if we take into account the timing issue. In fact, net Financial Result After subsidies becomes available after the realisation of operational loss in each calendar year. Thus the causality runs from *LOSS* to *FRA*.

Indeed, Proposition 1 states that for relatively high ω the net budget transfer should be lower implying higher franchise fee. In fact, SPCs with $\omega < 26\%$ are excluded in the first specification since local authorities in these companies have no effective corporate control, hence they are relatively lacking in opportunities to syphon out the upstream profits via ‘pseudo-franchises’. Presumably, a more intuitive way to distinguish between the structurally different partnerships would be to construct an alternative dummy which takes 1 if the LA’s share is above 50% and zero otherwise. However, this distinction proved to be statistically insignificant for our sample.

In turn, Proposition 2 and Corollary imply that if the monopolist’s participation constraint is binding, i.e. $(1 - \omega)F = V - K$, then the franchise fee weighted by the monopolist’s share in the partnership should be proportional to its variable profit V net of fixed cost K . As our theory on vertical partnerships implies, upstream profits cause downstream losses. Thus, the second econometric specification tests the validity of the monopolist’s participation constraint in the ‘pseudo-franchising’ regime. The estimation results are summarised in the following section.

5.3. Estimation results

Table 4 shows that for the subsample of SPCs with $\omega > 26\%$ three alternative estimation methods give qualitatively similar results: the coefficient for *LOSS* is positive and highly significant. Having considered the LM, Hausman and Wald test in a pairwise comparison of OLS, RE and FE models we conclude that the fixed-effects model is superior. Since the FE model controls for time-invariant differences between SPCs, the estimated coefficients are unbiased despite the existence of some omitted time-invariant characteristics. The first specification estimation results presented in Table 4 suggest that greater operational losses can largely explain insufficient government subsidies in SPCs with relatively higher influence of the local authorities.

The second econometric specification estimates the validity of the monopolist’s participation constraint for SPCs with different corporate structures and uses the whole sample of 124 observations. A new variable $(1 - \omega)FRA$ is constructed and interpreted as a weighted

Table 4
Estimation results for SPCs with $\omega > 26\%$.

Dependent variable <i>FRA</i>	OLS	FE	RE
<i>LOSS</i>	0.446 (12.11)***	0.788 (11.41)***	0.629 (11.38)***
<i>const</i>	-17.705 (0.64)	-206.218 (5.27)***	-115.684 (2.25)**
R ²	0.64	0.66	
N	84	84	84

*p < 0.1; **p < 0.05; ***p < 0.01.

Table 5
Estimation results for the effective franchise fee and full sample.

Dependent variable $(1 - \omega)FRA$	OLS	FE	RE
<i>LOSS</i>	0.674 (36.38)***	0.737 (76.04)***	0.733 (76.61)***
<i>const</i>	-208.594 (9.12)***	-230.412 (33.81)***	-228.721 (4.72)***
R ²	0.92	0.98	
N	124	124	124

*p < 0.1; **p < 0.05; ***p < 0.01.

franchise fee. The estimated coefficients for three alternative econometric methods are presented in Table 5.

Again a pairwise comparison of OLS vs. FE vs. RE models shows that the FE model dominates the competing models. Highly significant estimation results with the expected signs of the coefficients provide empirical support for the validity of our theoretical hypotheses. In particular, SPCs’ losses can be largely generated by the upstream profits of RZD from the provision of unregulated rolling stock and crew lease services, $LOSS \approx V$. A part of these losses, *FRA*, remains uncovered by the local budgets. This part is accounted in the consolidated financial result of RZD as losses of its downstream affiliates, $(1 - \omega)FRA$. Still variable upstream profit V may be sufficient to cover both fixed cost K and uncompensated downstream losses $(1 - \omega)FRA$. In this case the monopolist’s participation constraint is about to be met, $(1 - \omega)FRA \approx LOSS - K$, and it is willing to deliver intermediated services under the pseudo-franchising contractual regime.

6. Discussion and conclusion

We build a simple theoretical model of vertical partnership that considers a continuum of organisational structures ranging from the standard regulation of public service provision to complete contracting out of these services to a private unregulated monopoly. The vertical partnership is essentially a joint venture between the local authorities and the vertically integrated monopolist that provides the essential input for its downstream affiliate. In turn, the partnership delivers transportation services and receives subsidies from the local budget.

When the social planner chooses to contract out more transportation services, the LA’s share ω in the vertical partnership decreases as it becomes more commercially oriented. As a result, transportation tariffs increase which implies lower subsidies from the budget. At the same time, local authorities decrease their de jure corporate control in the partnership while the monopolist increases its bargaining power in a regulatory game. As a result it is able to increase the essential input price and reap the fruits in the upstream rather than the downstream market through its interest in the partnership.

The social planner can design an optimal shareholding structure of the partnership taking into account the local cost of public funds (λ) and preferences for redistribution of local politicians (α). An increase in the scope of contracting out and corresponding decrease in the share owned by the local authorities has two effects on the monopolist’s profit. On the one hand, the lower ω , the higher is the effective weight of the monopolist’s profit in the partnership’s objective function thus the higher is the regulated price in the downstream market. In turn, lower ω implies higher price c charged by the monopolist for the essential input and lower profit margin in the downstream market. In the extreme case when $\omega = 0$ the situation can be described as a regulatory capture since the price setting rule simply mimics the profit maximisation criteria. On the other hand, lower ω implies that higher share of uncompensated loss of the partnership is eventually passed to the monopolist through its interest in the partnership. Naturally, the monopoly level of output is socially suboptimal in general, so the local authorities would prefer to correct ex post the distribution of the total surplus in a socially optimal way.

In fact, the described mechanism of contracting out public transportation services to vertical partnerships has two instruments. At the ex ante stage the shareholding structure of the partnership is defined. At the ex post stage the size of commercial profits can be corrected via pseudo-franchise fee. This mechanism proposes a plausible explanation for the systematic loss of a public transport operator which is not fully covered by the local budget.

In the case of suburban rail transport in Russia, the fact that the subsidy ratio is less than 100% is interpreted as an attempt by the local authorities to extract the RZD's profit from the upstream market through a pseudo-franchise fee. Indeed, when SPC being a downstream affiliate of RZD makes losses that are not fully compensated by the local authorities, RZD consolidates them in its financial statement with a negative sign. If it decides to continue its business in the next year, it effectively pays an ex ante franchise fee for the monopoly right to serve the regulated downstream market with relatively predictable operating profit. If RZD knows the planned amount of the current year's subsidy in advance it is able to forecast the current year financial result and negotiate the scope of compensation ex post. These lump-sum amounts are to be determined exogenously and will not violate the optimum price and variable profit in the upstream market. Rather, it will affect the monopolist's participation constraint. In the absence of explicit competitive tendering procedures or detailed conditions and requirement for the direct award contracts, the described regulatory framework of pseudo-franchising scheme tends to be welfare improving.

Our model captures the basic stylized facts about the first results of the suburban railway reform in Russia. We believe that the idea of ex post contracting out public services via pseudo-franchise fees can also be applied to transportation sectors in developing countries with fiscally constrained governments. Our paper also contributes to the literature on regulatory cycles in public transport, pioneered by Gwilliam (2008), as we consider hybrid organisational arrangements and explicitly model a particular form of institutional inadequacy.

The original structural railway reform plan in suburban transportation sector in Russia attempted to account for relevant administrative capacities and socio-economics conditions at the regional level. Yet, the diversity in the local cost of public funds was largely ignored. The described regulatory environment is far from being robust and stable. In the absence of binding commitments to fully subsidise local public transport companies from the budget, it is not immune to abuse of RZD's monopoly power. Moreover, as Wong and Hensher (2018) point out, the framework with franchised monopolies is associated with regulatory capture issues. This problem has been actively debated in Russia. One of the proposed solutions has been to internalise the non-regulated price of rolling stock and crew leasing by transferring the associated assets' ownership rights to the partnership. In practical terms that would imply a vertical divestiture and privatisation of RZD's assets implying a complete redesign of the whole institutional framework in

the industry. We leave these issues for our further research.

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